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AUTHOR	Banister, Savilla
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ABSTRACT

This paper presents an overview of expectations educators have for computer use in the classroom, followed by a discussion of how technology and curriculum agendas relate (or do not relate) in schools. The paper examines the following questions: Does the introduction of computers into American classrooms affect the curriculum in these settings? What are the dynamics to be considered when technologies and curricula are elements of an educational environment? Do these two phenomena merely coexist within schools, or do they complement or destroy the other? Three possible models which explore the relationships of technology and curriculum are proposed and discussed in detail: (1) Technology as the Curriculum; (2) Curriculum as Technology; and (3) Alternative Vision. Contains 19 references. (AEF)

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Savilla Banister
Indiana University
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Technology and Curriculum: (Dis)Connections

As American schools enter the twenty-first century, voices of business, government, community, and academia crusade for increased technological development in classrooms. Up-to-date computers and state-of-the-art telecommunication systems are gradually becoming a part of many of our public school facilities. According to information from Education Market Research, the amount of money spent on school technology (hardware, software, distance learning, telecommunications) has steadily increased each year in the last decade, reaching over five billion dollars for the 1997/1998 school year (Felix, 1999). Behind these investments, lies an assortment of expectations that are sometimes difficult to articulate. Does the introduction of computers into the classrooms of America effect the curriculum in these settings? What are the dynamics to be considered when technologies and curricula are elements of an educational environment? Do these two phenomenon merely coexist within schools, or do they complement or destroy the other? These are the questions with which I will begin to wrestle in this article. I will present an overview of the expectations educators have for computer use in the classroom, followed by a discussion of exactly how technology and curriculum agendas relate (or don't relate) in our schools.

A strong interest in preparing students for the work force of the future drives one segment of the educational technology proponents. Business owners want students to learn the skills necessary to function in their job markets. They believe that placing computers in the classrooms will encourage the development of these skills. (Jamison, 1992) This concern with training students to meet the economic needs of the business

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community reflects the social efficiency model developed by Kliebard in his writings on the American curriculum. (Kliebard, 1995) For nearly one hundred years a segment of the American populace has advocated that the public schools train students to efficiently join the working world with practical skills. Vocational education programs are now being reconstructed into "tech prep" programs in high schools across the United States in order to satisfy this demand. "Computer literacy" is a term that is tossed about in this dialogue, though a clear definition of what is meant by the phrase is difficult to articulate(Snyder & Palmer, 1986).

Many advocates of computer-based education claim that students benefit from this method of instruction by experiencing a greater comprehension of the material being taught. The success of American classrooms has traditionally been measured by standardized tests, so linking technology to increased test scores is an attractive assertion. A multitude of research studies exists to demonstrate technology's positive effects on achievement. (Fabry & Higgs, 1997) Many of these studies are quantitative in nature, operating with both a control group and an experimental group and comparing the educational results through the use of pre- and post-tests. Control groups received instruction through more "traditional" teaching methods (i.e. lecture, textbooks, worksheets), while the experimental groups participated in computer-based instruction. Meta-analyses, consolidating the results of hundreds of these studies, revealed that the average student in the experimental group performed about .3 standard deviations better than the average person in the control group.

Though the amount of research demonstrating technology's ability to increase student achievement seems daunting, a closer look reveals cause for skepticism. Most of these studies have been short-term and have focused on drill and practice applications. The issues of higher-order thinking skills and influences other than the technology specifically were not addressed. Dillon and Gabbard report that, after

reviewing quantitative studies of hypermedia technology applications, the results were inconclusive. While the use of technology to teach various skills did not cause a decrease in student achievement, most achievement levels were similar to those in the control group. (Dillon & Gabbard, 1998)

In addition to the social efficiency and academic achievement rationales supporting technologies in the classroom, other advocates point to the motivational characteristics of computers in schools. In a review of the Buddy System Project, teachers, students, and parents reported that the computers placed in the students' homes as a component of the project motivated the children to do homework. "The computers are fun and the children not only don't mind, but often enjoy doing homework." (Duffy & McMahon, 1992)

The excitement of being allowed to do something apart from the normal school routine, such as work on the computer, can be very motivational for students. The use of multimedia programs or presentations can increase attention and students report that they are more attentive to classroom presentations that incorporate these elements. (Yaverbaum, Kulkarni, & Wood, 1997)

Since schools are expected to increase the amount of information known or understood by students, it is not surprising that technologies that promise to deliver a broader base of available information would be attractive to schools. Public school libraries have been renamed "media centers" and card catalogs have been replaced by databases. The fastest growing budget in the list of school technology expenditures is telecommunications, increasing thirty-three percent in the 1997/1998 school year to $266 million. (Felix, 1999) Interest in assuring that students and teachers have access to the legion of informational resources available through internet connections is high among government, business, and community leaders.

Besides the interest in social efficiency, increased achievement and motivation,

and information accessibility, computers in the classroom are being promoted as tools of collaboration and communication with those beyond the walls of the school building. Students and teachers are being encouraged to exchange ideas, work on projects and develop relationships with those who are accessible through the technologies of email and the internet. Barab and Duffy discuss the benefits of developing these "communities of practice" and site several examples of schools demonstrating this type of development. (Barab & Duffy, 1998)

Despite the overwhelming growth of technological additions to the classroom environment, and the many benefits proclaimed to result from their use, questions remain unanswered concerning the day to day classroom practices which utilize computers and the advantages that ensue. While some research reports that students are being better prepared to enter the work force, have increased test scores, are more motivated to learn, gain access to increased information, and are working in collaboration with others beyond the school walls, as well as with their peers, examples of these outcomes are not sufficient to give a complete picture. Though many studies have been done, and research continues, results remain inconclusive. Dillon and Gabbard reported,in their review of quantitative studies from 1990-1996 on the use of hypermedia as an educational technology, that there was no clear adoption of one learning theory in the research. Much of the work done in studying student use of computers reflected more pragmatic concerns, rather than theoretical. (Dillon & Gabbard, 1998) How is technology supporting or altering the curriculum in our schools? The following paragraphs attempt to present several possibilities.

For clarity's sake, working definitions of both curriculum and technology will be offered which, obviously, are open to challenge. Volumes have been written concerning either term, with little hope of consensus. Part of the difference in the way these words are defined stems from the variety of perspectives that accompany their

proposed meaning, and an attempt will also be made to describe some of these "camps", as they play out in the explanations that follow.

"Curriculum", as it will be used here, refers to the broad spectrum of content, skills, and attributes that a given teacher or school chooses to impart to students. In certain classrooms, the students, themselves, could be the ones deciding on the specific elements included in the curriculum. In either instance, "curriculum" will refer to the specific learning outcomes that are consciously chosen as the goals of the educational setting(Schubert, 1986)]. An effective argument has been made which claims that "teaching" and "curriculum" are synonymous (Willis & Schubert, 1991)], and it may be helpful to use these words interchangeably at times, to clarify the arguments being presented.

"Technology", in this text, refers to computers, software, internet connections, and most other companions of our expanding digital information age. It is interesting to note that "technologies" of the twentieth century have included such additions as the radio, filmstrip and overhead projector, phonograph, cassette tape recorder/player, television, and videotape and laser disc players -- each introduced into the schools with great excitement and expectations (Snyder & Palmer, 1986, [Bromley, 1998 #50)]. Reflecting on the impact of these earlier additions on teaching or curriculum may also prove helpful in gaining valuable insights into the (dis)connections of technology and curriculum in the twenty-first century.

With these suggested definitions in place, I will propose three possible models which explore the relationships of technology and curriculum: Technology as the Curriculum; Curriculum as Technology; and an Alternative Vision. It is my hope that this feeble attempt to examine these complicated phenomena will challenge teachers, administrators, parents, and students to consciously orchestrate their use of technology, relative to their goals for education.

Technology as the Curriculum

The current trend of placing computers in our schools with little preplanning encourages educators to focus on the technology and the skills required to manipulate it as the basis for instruction. Lessons plans concentrating on the "how to" aspects of the computer are seen as the path to developing the vague notion of "computer literacy" in our students. While learning about the computer may appear to be a worthwhile addition to the already over-taxed curricula of most schools, it necessarily forces other portions to be short-changed or discarded(Apple & Jungck, 1998). Technology as an isolated element of the educational program is altering the distribution of time and resources spent on other learning outcomes(Bromley, 1998). Teachers need to count the costs of including technology as a curricular element in its own right. Are there alternatives?

Those who believe that the curriculum needs to have immediate relevancy to the job market, see great benefits in incorporating computer use into the school program(Bromley & Apple, 1998). In this social efficiency mind set, the skills students acquire in using the computer are quite valuable in our economy, and, therefore, worth the investment(Egan, 1999). If introducing technology as an important facet of the curriculum results in excluding other, less marketable, skills in music or algebra, for example, proponents support the reductions.

While giving students experiences with computers to prepare them for future employability may seem admirable, it is difficult to predict the exact technological skills that will be needed in the future. Technologies are changing and expanding at a breathtaking rate, and schools will be hard pressed to offer training and equipment that could continue to be representative of the marketplace. It is also prudent to realize that the majority of adults who are using the technologies currently did not have

experience with these applications during their public school years. Technology for technology's sake does not appear to be a compelling curricular choice.

Curriculum as Technology

If "computer literacy" alone is not a worthwhile use of computers in the classroom, then why not use the technology to teach the content and skills that are more traditionally a part of the school domain? Educational software is available for almost any school subject at any grade level. Transplanting our curriculum into a technological context seems to be a viable alternative. Students will gain the basic operational skills of the computer, in addition to learning the content, skills, or attributes defined in our curricular goals. Curriculum as technology could be the answer to enabling students to more effectively learn in our schools. Let's examine this premise a bit further.

Obviously, the effectiveness of this model is largely dependent on the software used and how well that software can influence student learning in specific curricular domains. To investigate this scenario, it is necessary to have a rudimentary understanding of software design and to separate software into a few categories, in order to evaluate each type's usefulness in school. For the purpose of this article, I will propose four categories of educational software: drill and practice programs, non-interactive tutorials, interactive tutorials, and games and simulations.

Drill and practice programs are available for any content area in which rote memorization is desired. Mathematics, spelling, geography, science, art...any of these subject areas could conceivably be reduced to a list of facts to memorize (and probably have been!). To design such programs does not require an excessive amount of energy or expertise. This type of software can be made more interesting (and more expensive) by adding fancy sounds and graphics which are triggered by correct and incorrect responses. Some may track individual student progress over

time, and even feature the ability to record and rank entire classes according to performance. Some refer to this type of software as "electronic flash cards" and educators need to question the value of requiring students to endure this dribble in the name of education. While drill and practice software may prove beneficial for some students in a few circumstances, teachers would have difficulty defending its use on a large scale to accomplish curricular goals.

Non-interactive tutorial software could be described as electronic textbooks or Computer Assisted Instruction (CAI). This type of programming is a step above the "kill and drill"variety, presenting a richer content, but still relying on memorization (or learning) of the material presented in incremental steps in order to progress through the subject matter(Snyder & Palmer, 1986). If a school's goals for students includes the ability to regurgitate selected bits of information, this type of programming could be deemed useful. Since it is a relatively simple process to design tutorial software from an existing text, textbook publishers who can include such an option with their product can easily find a market.

While students may be engaged, to an extent, by this approach, it is doubtful that a steady diet of digital tutorials can nutritiously feed hungry, young minds. By design, the tutorial cannot answer questions that have not been programmed into the existing format, it cannot offer additional examples when a pupil needs further explanation, and it cannot provide interesting anecdotes that might spark the "Aha!" of sudden understanding for a particular student. In other words, the computer is unable to be as effective as a teacher in these circumstances(Scott, 1998). Few educators would defend a curriculum promoting rigid, "by-the-book" memorization of content alone, and software that offers little else should be discarded.

If the tutorials described above are embellished with interactivity, allowing students to move through the information in a non-linear style, can the curriculum be

more effectively assimilated? Interactive software provides options in which questions could be answered, areas explored in more depth, and additional illustrations provided. Of course, this necessarily involves a more complex design and a more labor-intense development process. It is unlikely that even the most insightful and energetic of design teams could include enough branches in the program to simulate the possibilities that might occur in a classroom actively engaged in conversation about a an issue, but allowing some room for exploration and enrichment is an improvement. Again, good classroom teachers have the advantage over computers in addressing individual learning styles and customizing the lesson to a particular audience. To even attempt to create a program that could present this type of tailored instruction would be costly and time-consuming to a prohibitive degree(Farmer, 1997). Interactive tutorials, then, still fall short in representing the curriculum.

Games and simulations are yet another type of software being developed for educational use. Well-constructed programs of this type are able to more actively engage students, than many of the formats discussed previously. Tom Snyder explains how well-constructed programs of this type can provide students with an exciting platform in which to explore a variety of areas. Rather than be isolated, computer-centered endeavors, games and simulations can be tools which encourage cooperation and research among students (Snyder & Palmer, 1986). Again, the key to success in this medium centers around detailed and imaginative design, which translates into complicated production and higher costs. Teachers may be able to invest in some of this type of software which realistically correlates with their curriculum in an effective way, especially if teacher/student interaction is a vital part of the program design.

Encapsulating curriculum into a technological format is difficult to accomplish in

a meaningful way. Much of the reason for this dilemma revolves around the "top-down" style in which software is produced for the classroom. Much of what is adopted as instructional design strategies for educational software has its roots in military development(Snyder & Palmer, 1986) and so it is not surprising that the teacher's goals for instruction are not adequately addressed. As long as textbook publishers and computer software companies can continue to market products of dubious merit with claims of educational miracles, teachers need to be wary.

An Alternative Vision

"Educational computing is largely technology-driven rather than curriculum-driven." (Bromley, 1998, pg. 21). Research shows that teaching changes with the use of computers (Provenzo, Brett, & McCloskey, 1999), but studies fail to show that these changes are providing benefits in accomplishing the curricular goals of the classroom. Just as the "curriculum can be constructed now in the 'lived space' of the classroom" (Pinar, Reynolds, Slattery, & Taubman, 1996, pg. 860) , technology use must be orchestrated by individual teachers with specific needs and goals.

Teachers need the time and resources to learn about the many applications that technological advances can afford. Opportunities to use and evaluate hardware and software options before purchase would allow educators to compare their curriculum to the technology in a more thoughtful fashion. School districts can begin to trust teachers to make competent decisions regarding computer use, rather than mandating its use in an effort to appease business and governmental interests. Technologies can be productively integrated into the instructional objectives of the school, but such an incorporation will take time and thought from classroom teachers who have the power to transform the dynamics of the situation.

As educators begin to clearly define the roles of computers in their classrooms and experience the freedom of choosing or creating technological methods or

materials that truly enable the process of teaching, a new vision can begin to emerge. A vision of technology and curriculum will real connections to teaching and learning.

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